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AF FORM 112—PART II
APPROVED 1 JUNE 1948

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(CLASSIFICATION)

AIR INTELLIGENCE INFORMATION REPORT

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1. Modification of Schmetterling Ground Control Station: [redacted]

In the original model, both ceramic cylinders (one for elevation, the other for azimuth control) were mounted solidly on a common shaft and thus rotated at the same speed. In the modified version, these cylinders were mounted on individual shafts and were geared to operate at different RPM's, thus creating one frequency for elevation and one for azimuth control.

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The gears for this modification were designed by May 1947, but were not actually constructed. [redacted]

2. Large Water Canal: The water canal which was designed about 1947 by H. Scrader in Ostashkov, and which was built in Moscow, arrived in April 1948 on Gorodomlya Island and was assembled in a specially designed building in May 1948 (See Figure 2). Damage sustained during the transfer was repaired and the glass plates were inserted. The canal was levelled with the aid of theodolites. A large Laval nozzle for Mach 2.13 was delivered. For higher Mach numbers, other nozzles were to be constructed later. Actual experiments were not conducted in the large water canal until Spring 1950, after the weir (Figure 3) was developed and built. In addition, a 9 KW electric motor to drive a centrifugal pump was installed to operate the canal. Later a gate-valve was built at the end of the experimental area, in order to increase the back-pressure and/or build up the water level. A large wooden lattice-work was placed in the reservoir and floated in front of the rectifier (a device which smoothed the flow of water in one direction), in order to calm the waves in the reservoir and to avoid pulsation in the water flow.

Optical rails which ran along the canal's side walls served as a mount for securing the stand for the water level gauge, the scales, and the support for the motion picture camera.

An adjustable overflow tube was installed behind the rectifier for quick readings and control of the water level. A manometer for reading Pitot pressure was placed on the front canal wall. (See Figure 4, for details of Pitot Tube).

The electrical power for the operation of all laboratory equipment on Gorodomlya Island was supplied by three or four rather antequated 200 Volt diesel drive generators. These same generators also supplied the entire residential area. This necessitated the restriction of private use of electrical power during the day to ensure a reasonable supply for the laboratories. Even so, the voltage regulation was so poor and variable that operation of the water canal was always difficult. Deviations in the current supply resulted in uneven water pump action, which in turn lowered or raised the water level and velocity in the canal at a greater rate than the overflow valve could compensate for.

This canal was dismantled about August 1952 and was removed from the island, presumably to Moscow. [redacted] there is a second water canal in the USSR (Moscow?). 50X1-HUM

3. Experiments in the Large Water Canal: The large water canal had been built

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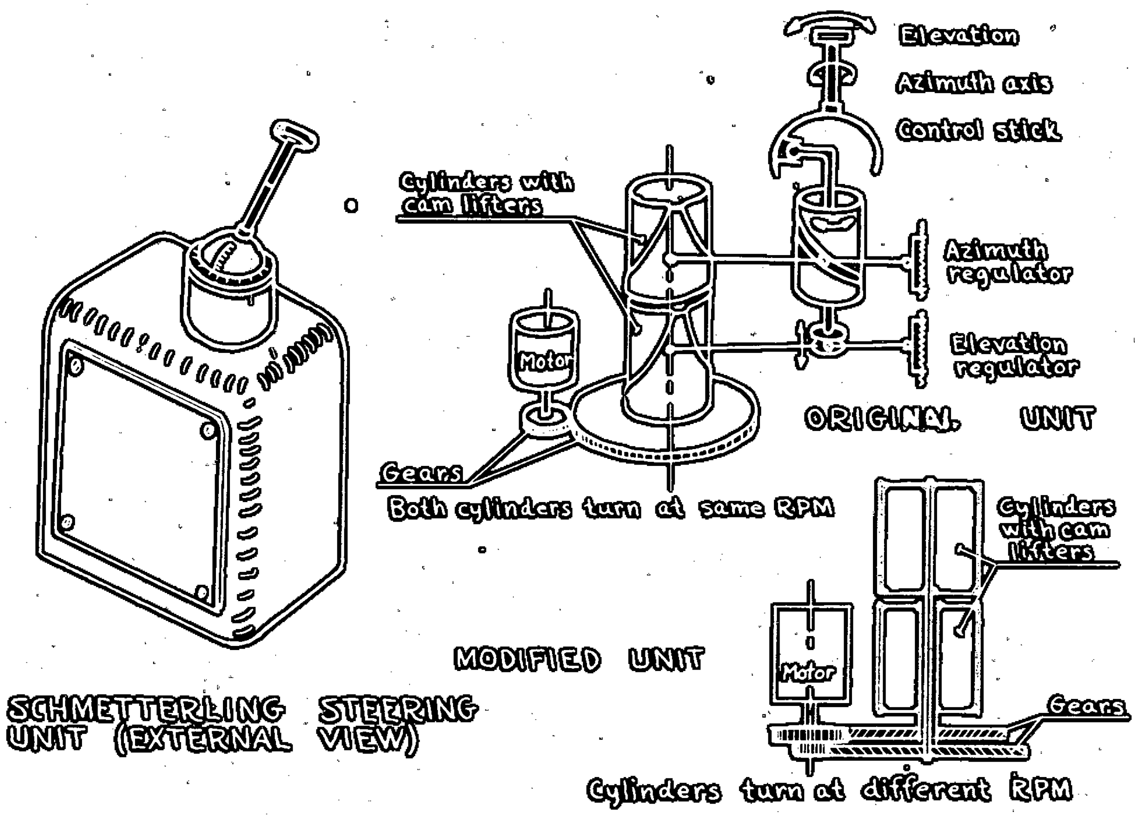

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FIGURE 1
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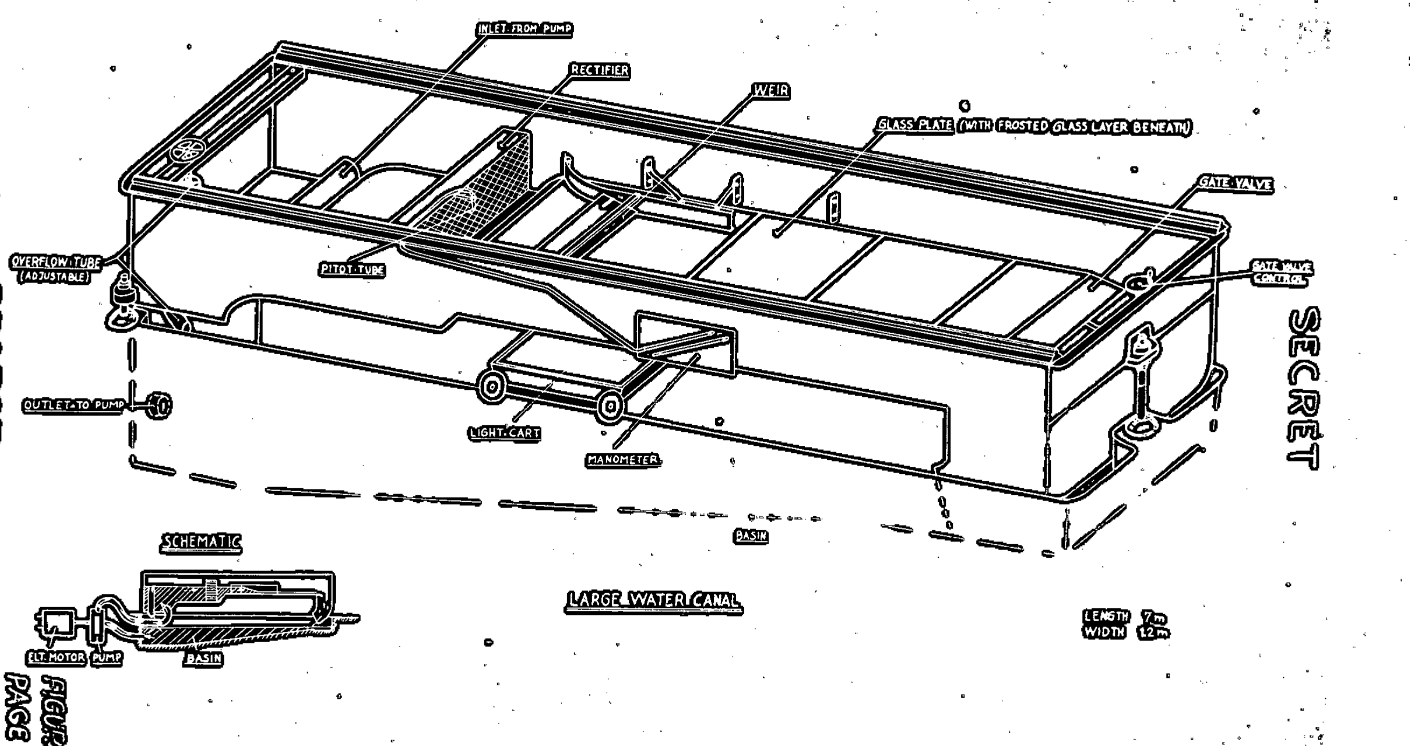

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FIGURE 2
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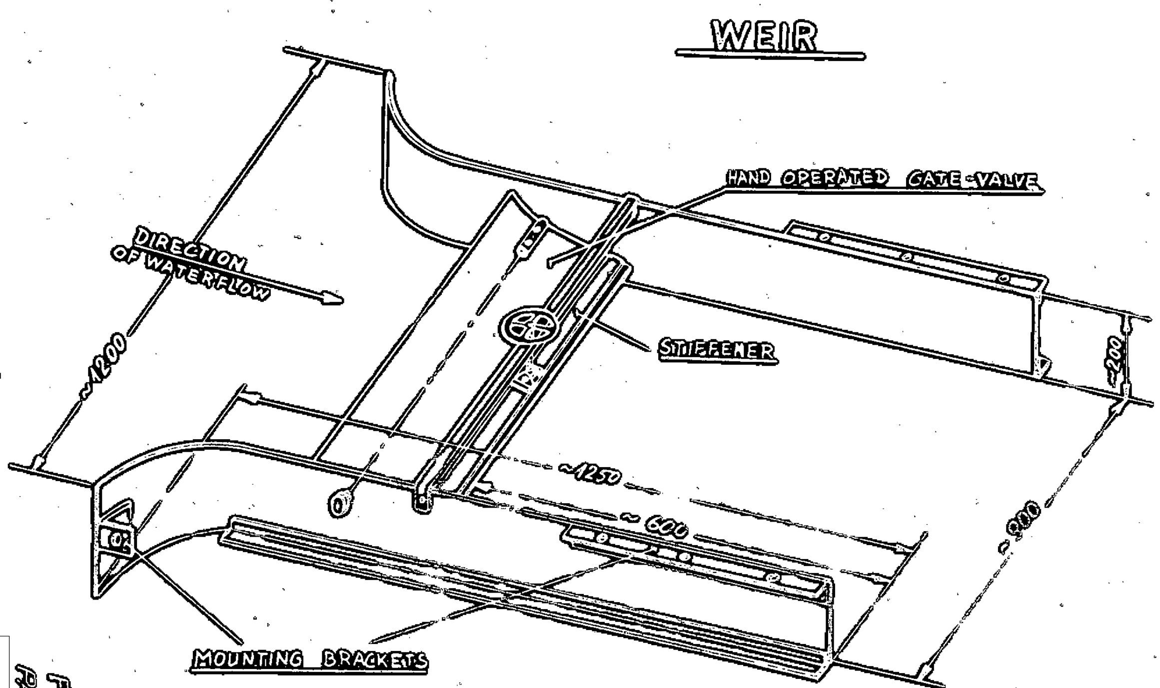

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FIGURE 3
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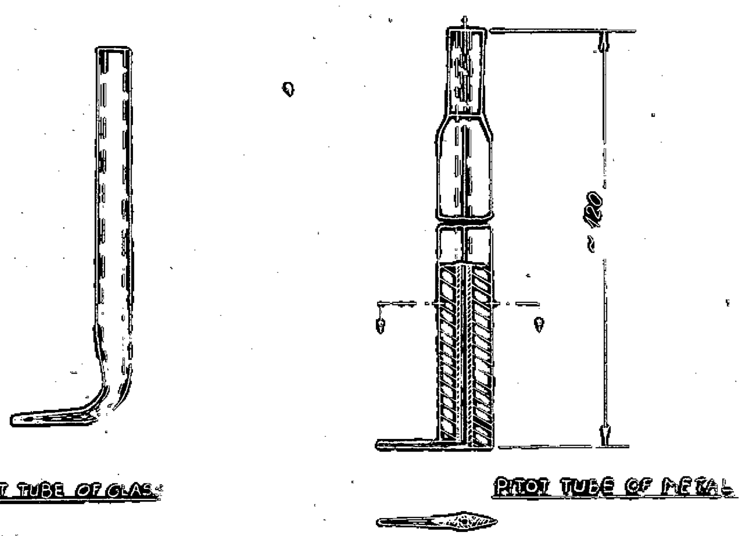

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FIGURE 4
PAGE 6

PITOT TUBE USED IN BOTH LARGE AND SMALL WATER CANAL

SCALE 1:1

for operation with Laval nozzles, but the first experiments showed that the length of the nozzle (approximately 3m) caused a boundry layer which made exact measurements impossible. Work in the canal was only made possible with the introduction of the weir.

The first experiments were to determine the coefficients of lift and drag on wedge and ojive shaped models of various sizes (See Figure 5), at different angles of attack and at different Mach numbers. Later comparative measurements were made by means of a Yaw-scale and Drag-scale.

At the same time, measurements were made on various diffusors; (See Figure 6), diffusors with parallel guide vanes, with converging guide vanes, and diffusors according to ABRAMOVITCH were tested. (Note: ABRAMOVITCH is a Russian who published a book on aerodynamics, containing a section devoted to the discussion of various configurations for diffusors. The German scientists working at Ostashkov used this one configuration in their experiments.) Then followed a series of experiments of expansion nozzles with various angles of opening at various counter pressures (See Figure 7).

[redacted] employed the water canal for experiments on a model high pressure injector for the wind tunnel. (See Figure 8). 50X1-HUM

Occasionally experiments were made for wind tunnel projects which were more easily defined in the water canal; for example, the trial of a wind tunnel model mount, (See Figure 9), designed to avoid distortion of the low pressure area immediately behind the missile model. This distortion had previously been produced by a shock wave from the mount itself, therefore, this new design was created to alleviate this condition.

Another series of experiments (See Figure 10) was devoted to the ascertainment of critical Mach numbers by various D/H (relation of width of models to width of canal). [redacted] this experiment was made for comparison purposes with wind tunnel experiments. A description of this Series of Shock Wave Experiments which was conducted from the end of 1951 through the first part of 1952 for Dr. ALBRING and FREISER follows: 50X1-HUM

Under direction from Moscow (NII 88), a series of experiments was conducted on various configurations of rocket models. (See Figure 11). Measurements were made at angles of attack of 0°, 5°, 10°, 15°, 30°, 45°, 60°, 75°, 90°, 135°, and 180° and at varying Mach numbers.

BOGOMOLOV, a student from Moscow, carried out a series of experiments, [redacted] on models with inter-changeable heads, center sections and tail pieces of various lengths. (See Figure 12). These experiments were recorded photographically and the film was given to Bogomolov. 50X1-HUM

4. __Shock Wave Experiments:__ Experiments were made on the speed and expansion of shock waves with various war-head shapes. These were conducted in the water canal, however, the water was dammed at both ends thus forming a basin. A description of this series of shock wave experiments, which was conducted from the end of 1951 thru the first part of 1952 [redacted] 50X1-HUM

a. Figure 13 shows the arrangement of the water canal and associated equipment during a typical experiment.

b. Figure 14 shows details of the models tested. These models were made of sheet aluminum, 2mm thick, welded and smoothly finished to exact measurements.

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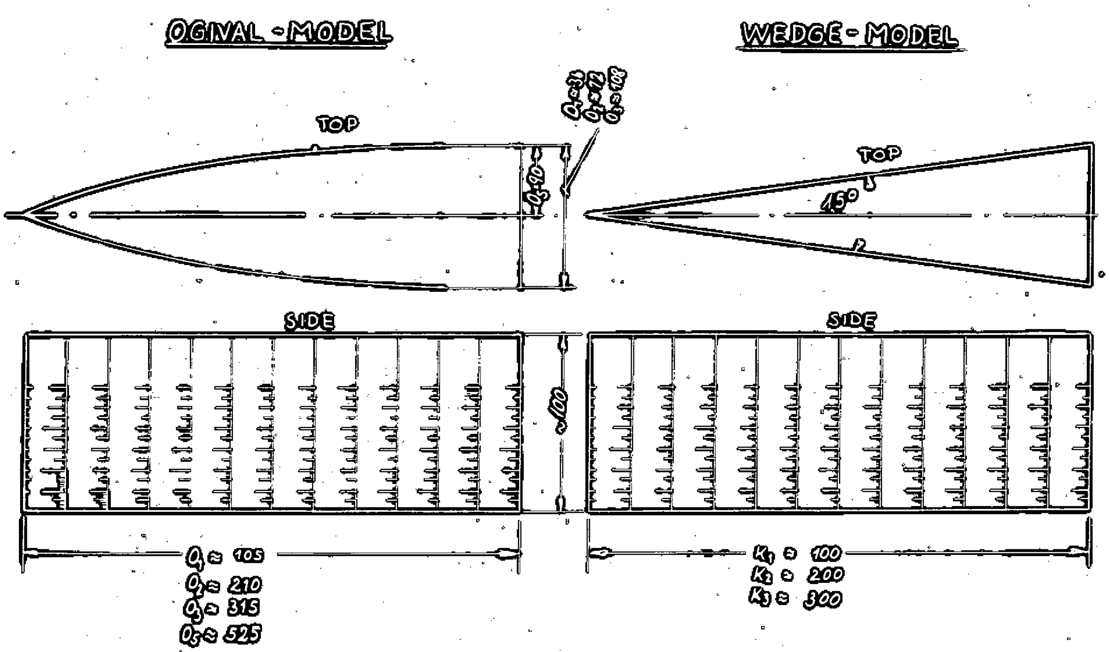

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FIGURE 5
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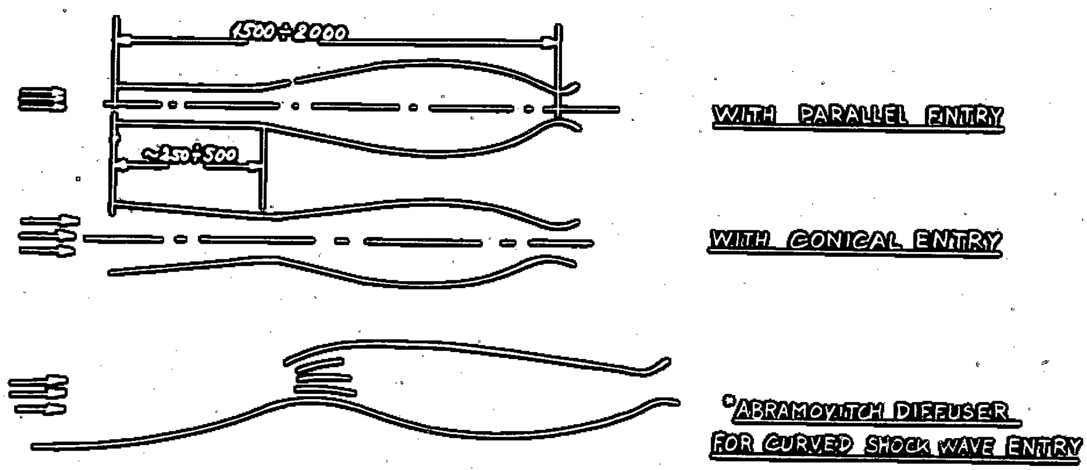

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FIGURE 6
PAGE 9

DIFFUSER

* SEE TEXT

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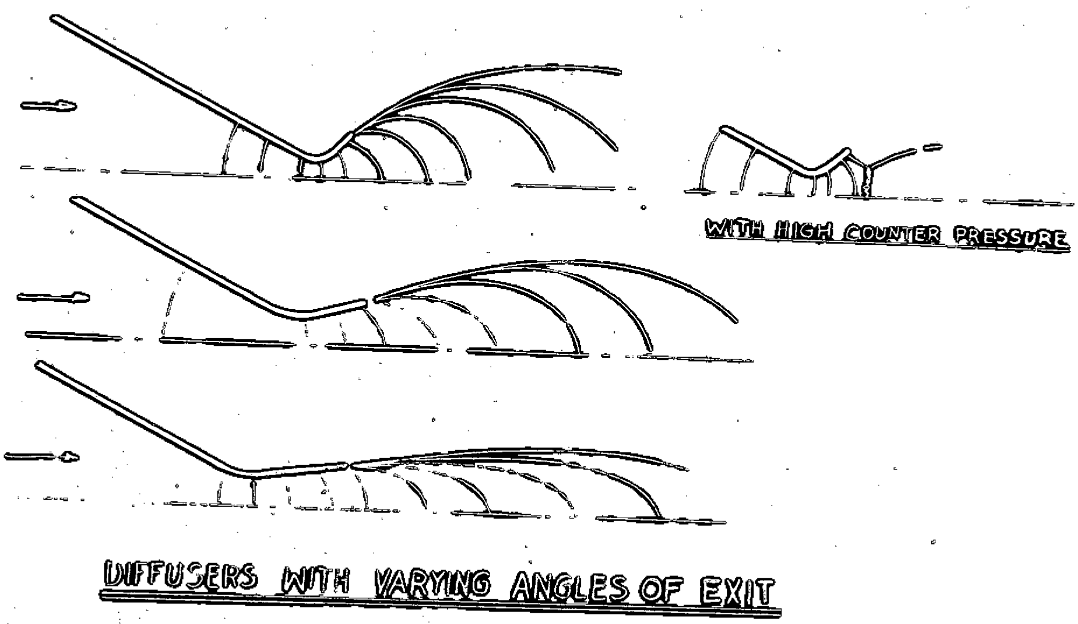

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FIGURE 7
PAGE 10

DIFFUSERS WITH VARYING ANGLES OF EXIT

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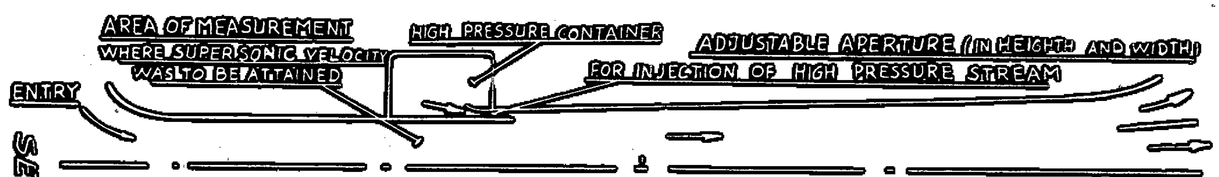

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EXPERIMENT ON THE CONSTRUCTION OF A MODEL INJECTOR TYPE SUPER SONIC WIND TUNNEL

FIGURE 8
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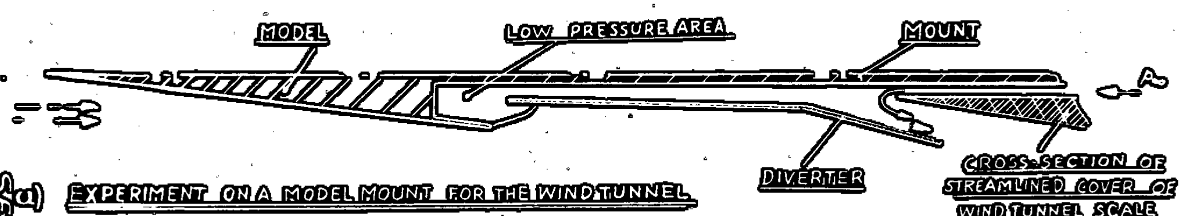

a) EXPERIMENT ON A MODEL MOUNT FOR THE WIND TUNNEL

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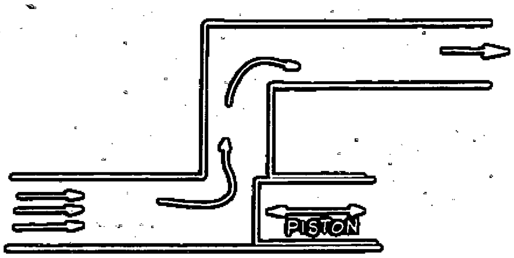

b) EXAMINATION OF THE AIRSTREAM AT THE QUICK CLOSING VALVE FOR THE WIND TUNNEL
(EXPERIMENTAL LAY-OUT)

FIGURE 9
PAGE 12

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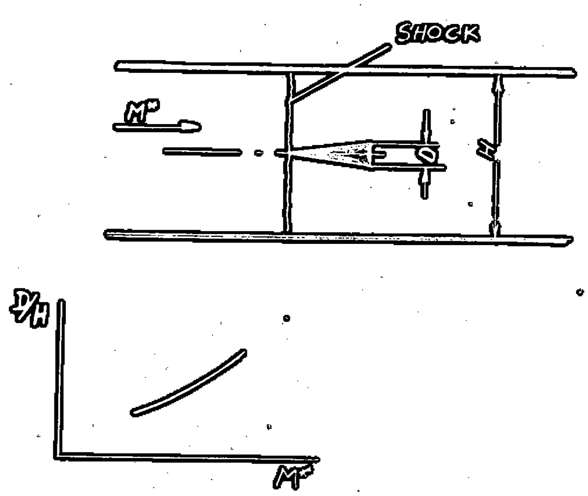

H = CANAL WIDTH
D = MODEL WIDTH
M^* = CRITICAL MACH NUMBER

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FIGURE 10
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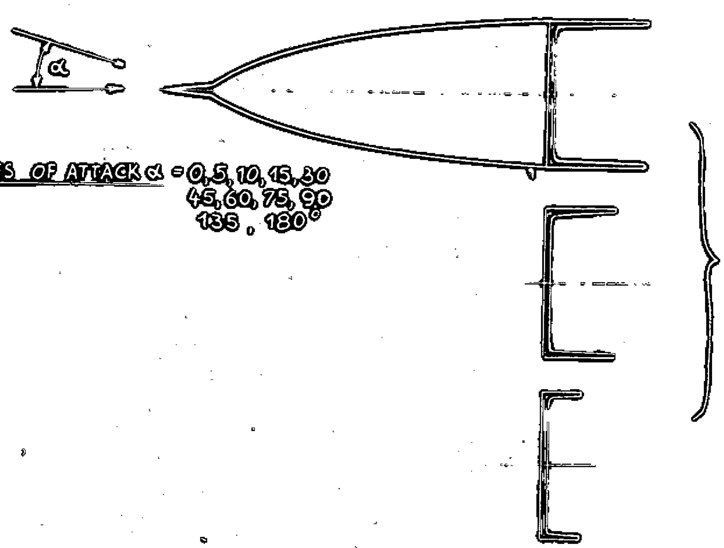

FIGURE 11
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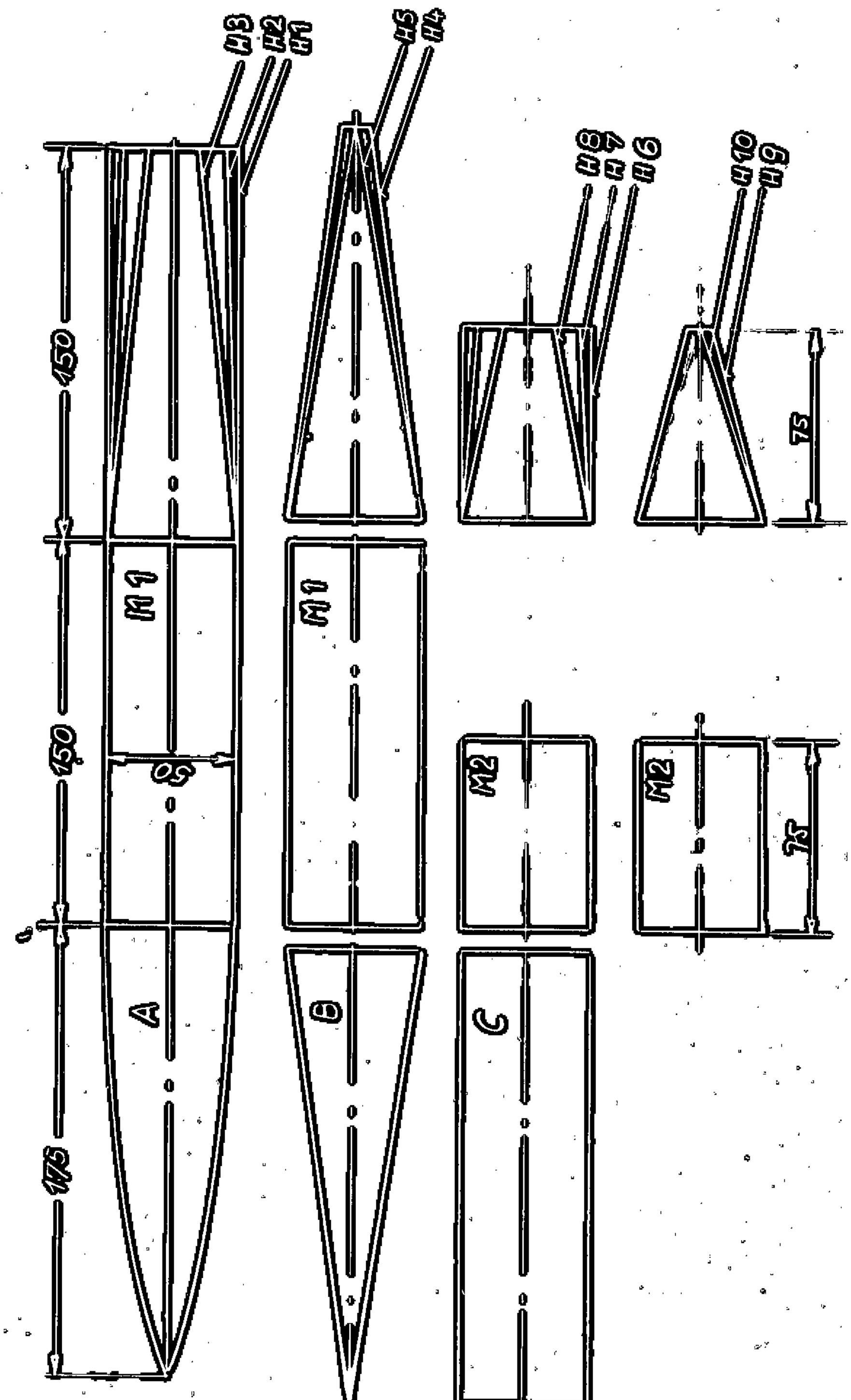

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FIGURE 12
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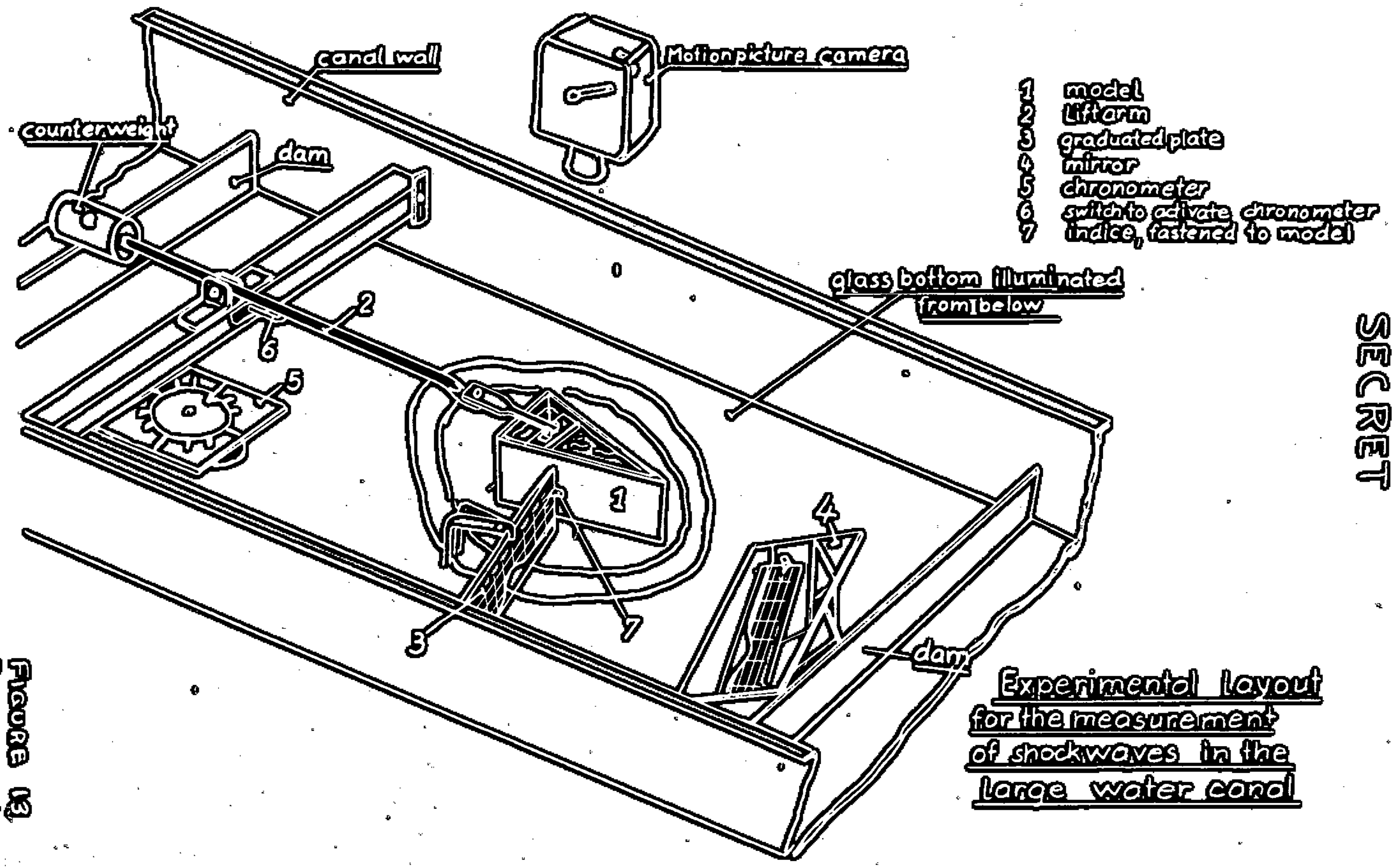

Experimental Layout for the measurement of shockwaves in the large water canal

FIGURE 13
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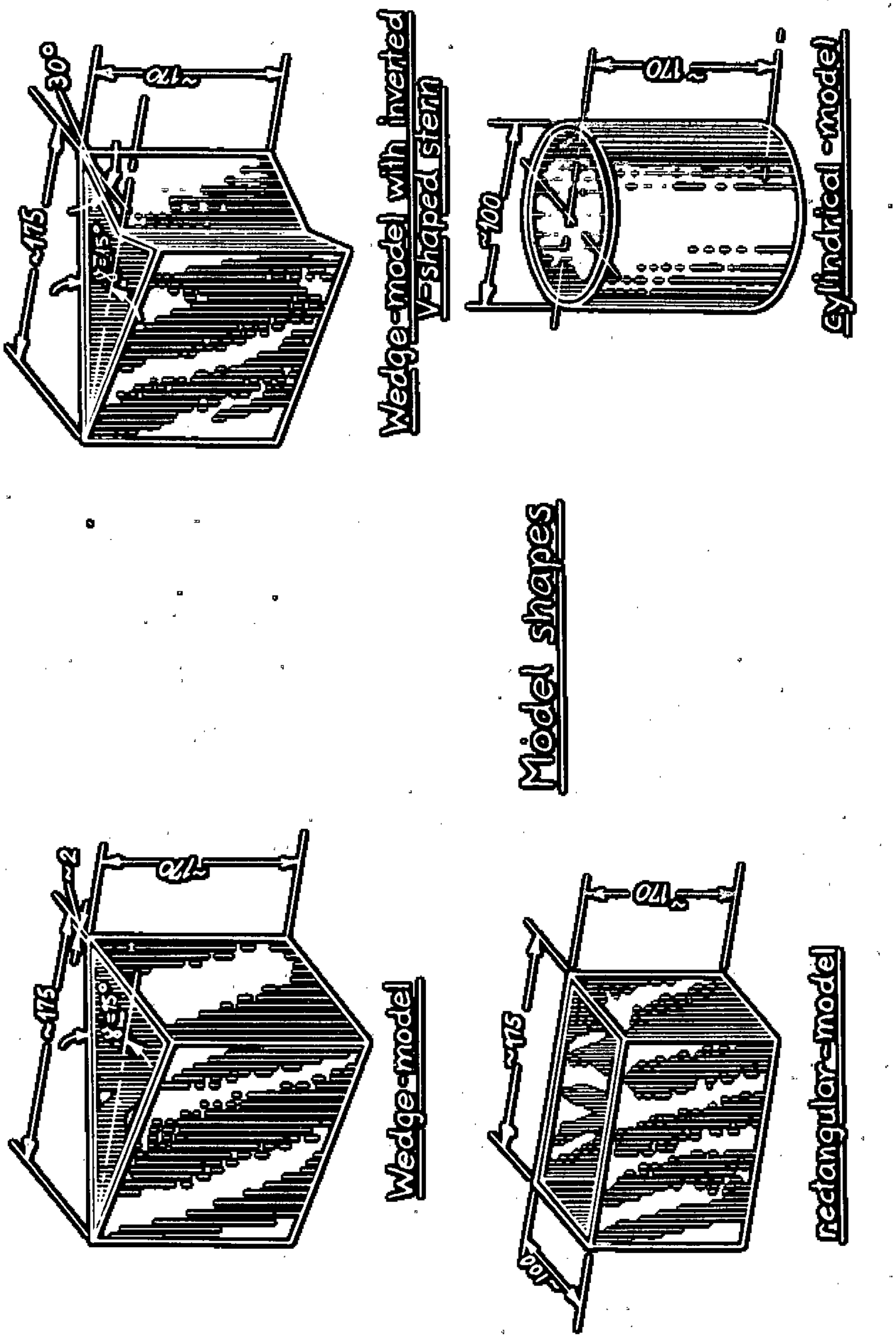

FIGURE 16
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c. The equipment used on the water canal as shown in Figure 13 is described below:

(1) Lift Arm (#7, Figure 13): This device, used for raising the model, was fastened on a traverse which in turn was mounted on the walls of the canal. The model was attached at one end to a section of plexiglass with a counterweight on the other end. The lift arm itself was made of dural aluminum.

(2) Chronograph (#5, Figure 13): This chronograph was calibrated to read 1 second per cycle and was activated by a contact switch (#6, Figure 13) on the lift arm.

(3) Dural Plate (#3, Figure 13): This dural plate, or [illegible] device, was etched with graduated lines and an index scale. This plate was placed vertically in the canal at right angles to the side of the model being tested.

(4) Mirror (#4, Figure 13): This is a standard mirror, without frame, so placed that the image of the Dural plate was reflected into the view of the motion picture camera.

(5) Dam Plates (Begrenzungs Platte): These plates were used to dam the canal at both ends so that it could be used as a basin for these experiments.

(6) Motion Picture Camera: This was a specially designed camera which operated at 33 frames per second.

d. Preparation for a Typical Experiment:

The model to be examined was mounted on the plexiglass strip at one end of the lift arm and sealed to the plate glass floor with petroleum jelly. The Dural plate with the etched lines was placed at right angles to the side of the model and secured against displacement by means of lead weights. An indice attached to the model was set at the 0 value on the index scale of the plate. This scale, upon calibration, measured the space between the bottom of the model and the plate glass floor of the canal. The mirror was then adjusted so that the water action at the Dural plate was in the field of view of the motion picture camera which was mounted directly over the model at a distance of 1.2 meters. The dam plates were placed in position and the basin thus formed was then inundated to a level of about 1 to 2 cm.

e. The Experiment:

The model was filled, to a height of 150 to 160mm, with red dyed water. The chronometer was set at 0 and the motion picture camera started. Then, by pressing the counter-weight on the lift arm, the model was raised allowing the dyed water to flow out and form the pattern of the shock wave thus created. Simultaneously, the contact switch was closed activating the chronometer.

The motion picture camera then recorded the following data:

(1) The expansion and configuration of the shock wave from above.
(2) The heighth of the model from the glass plate floor.
(3) The shape and movement of the shock wave in vertical cross section as reflected by the mirror from the Dural plate.
(4) The time as registered by the chronometer.

f. Results:

The data thus obtained was then recorded from the film and calculations

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[redacted] 50X1

made of the speed and shape of the shock waves. This data was then turned over to the Aerodynamics Department and Source does not know how it was utilized.

5. Multiple Manometer for Water Tunnel: A water pressure pick-up plate used in conjunction with a multiple manometer was developed, (see Figure 15), to examine stern waves in a supersonic stream. The dynamic pressure at a given hole in the pick-up plate was measured and read on the manometer. Tests were made at various supersonic Mach numbers and at different angles of attack. Since the results agreed with those obtained optically (reading of water levels on the millimeter graduated plate), only a short series of experiments was made.

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[redacted]

7. Rocket Motor Construction: One of the most interesting projects [redacted] 50X1-HUM was the construction of a small, Russian designed, rocket combustion chamber. Two of these motors were built in a restricted area of the workshop in the fall of 1951. The component parts were made almost entirely by Soviet workers. Only a small part of the necessary welding and drilling operations was done by Germans, and that only to meet a delivery deadline to the test stand. Some time after completion of the first motor, it was returned to the workshop for repair. The throat section of the exhaust nozzel had been completely burned through. At this time, the second motor was built.

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[redacted] (See Figure 16). However, it should be noted that all measurements and arrangement of components is only approximate.

The nozzel portion consisted of two conical and a cylindrical section which were welded together. Both the inner wall and outer wall were constructed in the same manner and joined by welding, small metal spacers between the two thus forming the cooling jacket thru which fuel was forced to flow before reaching the injectors. The tolerances of this spacing arrangement were very closely controlled on the second motor as this was thought to be the underlying cause of the failure of the first motor.

The injector head was drilled with an unknown number of holes in a circular pattern. These holes were at definite angles in relation to each other. The fuel and oxidizer was injected thru these holes in an impinging flow.

The combustion chamber was cylindrical in shape and therefore, offered no difficulties in construction as there was only one weld on each wall.

8. Electro-Magnetic Clutch: About September 1953, Source received an order to build an electro-magnetic clutch designed for the transmission of high RPM with minimum lag time between engaging and disengaging.

The main difficulty in construction arose in the fabrication of the clutch elements. These elements consisted of a magnet and anchor made up of twelve segments each. (See Figure 17). Each segment, in turn, consisted of four "U" shaped pieces made from ARCO (a sheet metal of low carbon content, 0.3mm thick.) which were glued together with BF-4 glue. This process proved strong enough to withstand the milling necessary to bring the segments to the proper dimensions.

[illegible]

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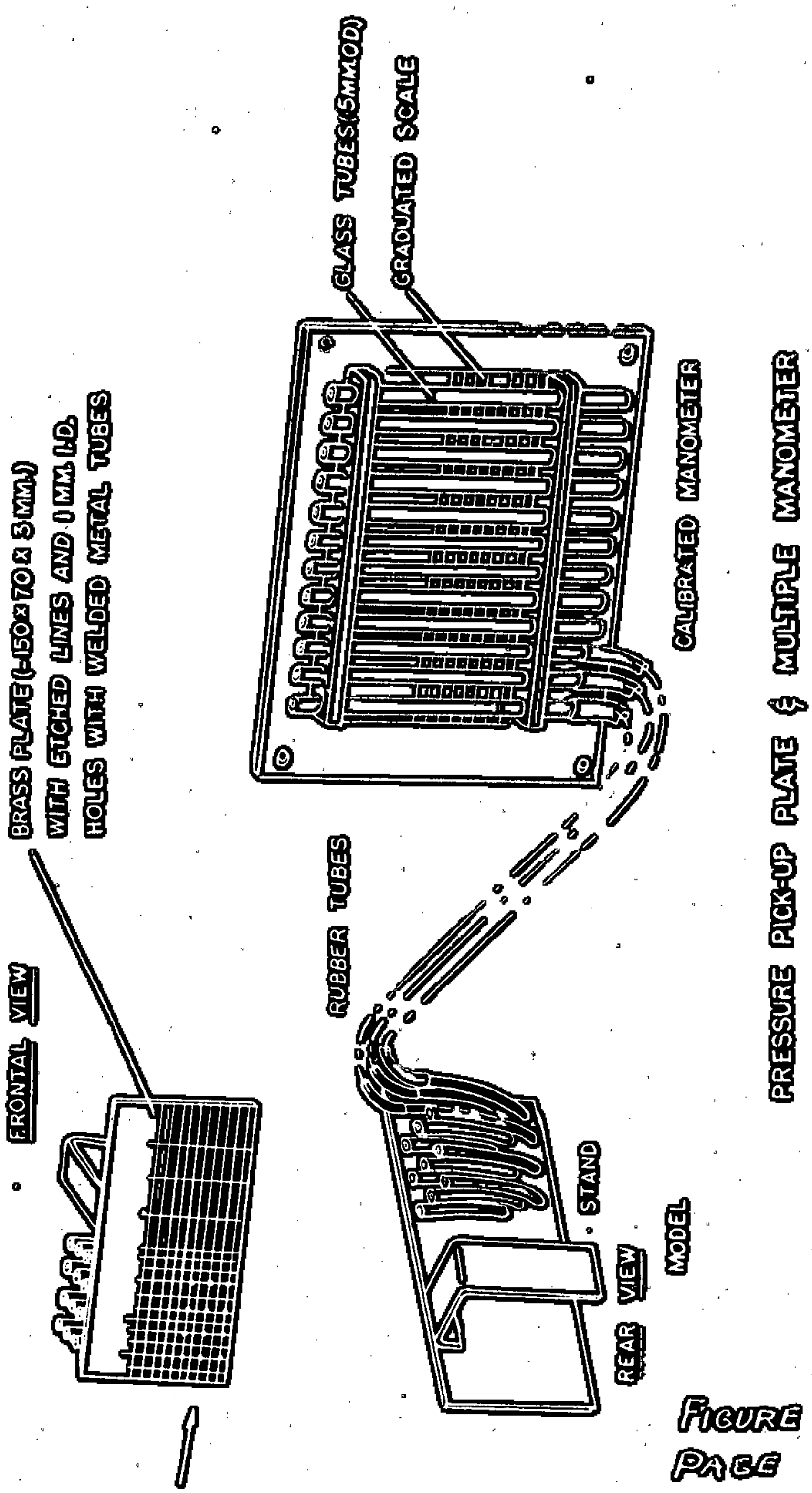

FIGURE 15
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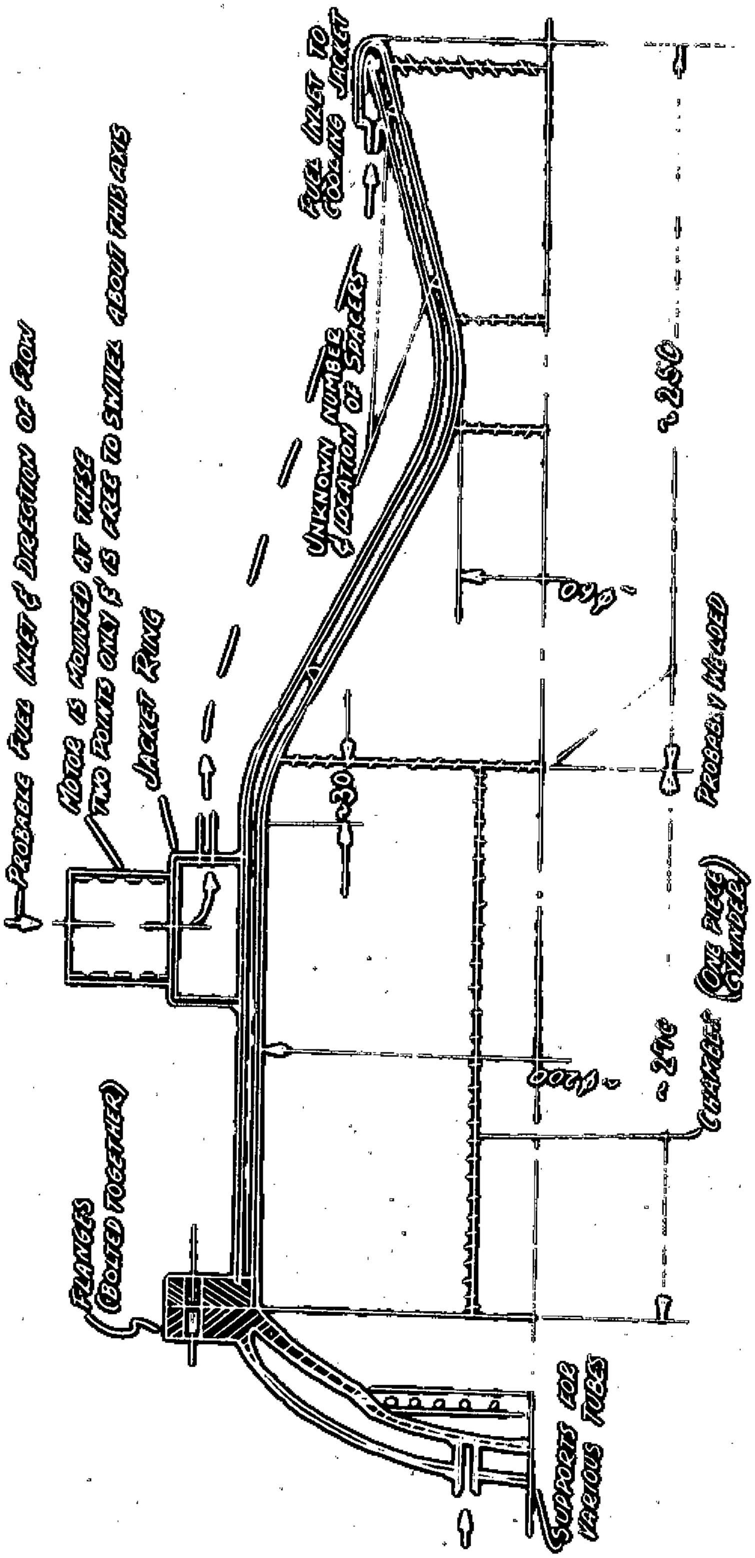

SMALL RUSSIAN DESIGNED ROCKET MOTOR
CONSTRUCTED AT OSTOSHKOV, SEPTEMBER 1952

FIGURE 16
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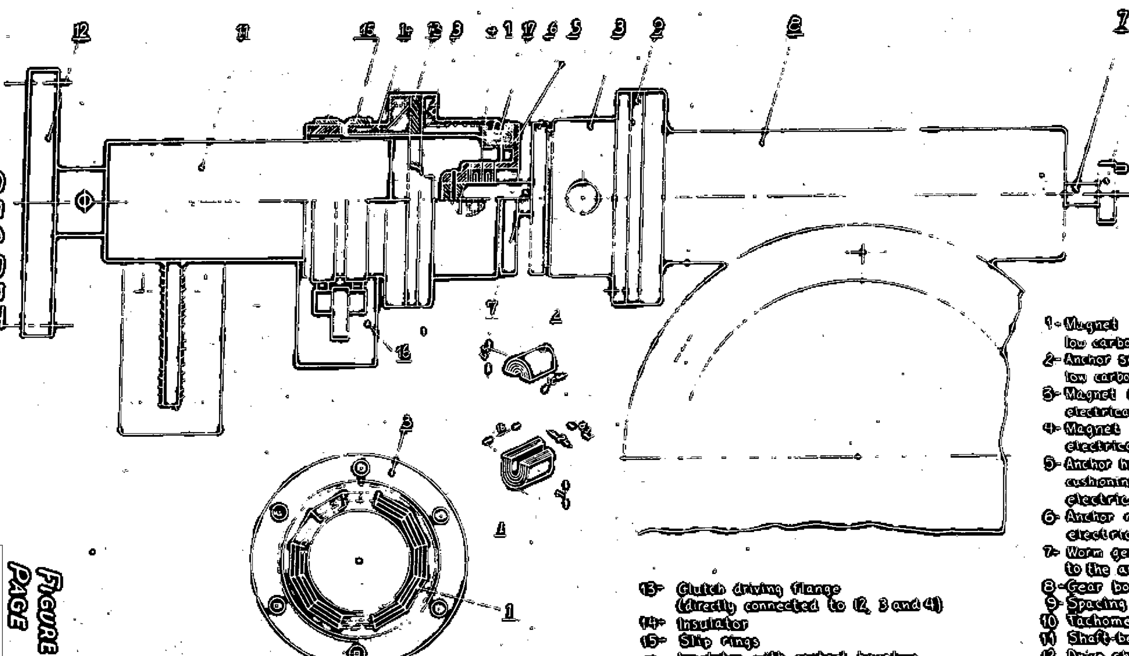

1- Magnet segments (ARMCO, low carbon content metal)
2- Anchor segments((ARMCO, low carbon content metal)
3- Magnet housing (Dural-electrically oxidated)
4- Magnet ring (Dural-electrically oxidated)
5- Anchor housing with slits for cushioning action (Dural-electrically oxidated)
6- Anchor ring (Dural-electrically oxidated)
7- Worm gear (connected directly to the anchor housing)
8- Gear box
9- Spacing ring
10 Tachometer drive
11 Shaft-bearing housing
12 Drive shaft coupling flange (to motor)
13- Clutch driving flange (directly connected to 12, 3 and 4)
14- Insulator
15- Slip rings
16- Insulator with contact brushes
17- Magnet core

ELECTRO-MAGNETIC CLUTCH

FIGURE 17
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For the final construction, minor changes were made in measurements and thicker sheet metal (0.5mm as opposed to a previously used 0.3mm) were used. The layer of glue was meant to serve simultaneously as a welding agent and as insulation between the segment layers to avoid eddy currents. However, the first experimental segment made showed that the glue alone did not offer sufficient insulation. After a lengthy series of experiments, a satisfactory solution was found. The ARCO metal sheets were cut slightly over final size, cleaned with sandpaper and pre-shaped. They were then degreased with acetone, and coated with glue (BF-4). Then they were dried one hour at room temperature, one hour at 55°-60° centigrade; again each was coated with glue, dried one hour at room temperature, one hour at 55°-60°C and about 30 minutes at 90°C. At the same time, bands of natural silk were coated on both sides with glue (BF-4), stretched and dried at room temperature. Then the four elements of sheet metal, each separated by a layer of the treated silk, were placed in a jig and heated under slight pressure for 90 minutes at 120°C. (Though the directions on the glue prescribed higher temperatures, a maximum of 120°C was used because the silk would char at higher temperatures.) Now the segment could be milled down to its correct size. Often times, during the milling process, the silk insulation layer became impregnated with metal shavings thus destroying the insulation qualities. To obviate this condition, the segments were cauterized with nitric acid.

When completed, the twelve segments were fitted into the magnet and/or anchor housing. This housing was anodized black (insulated by electrical oxidation) and coated with the above described process. It happened that the previously perfect segments developed grounds and short circuits. However, because of a deadline to be met, these segments were used anyway. The space for the magnet core, which had been formed in a mold, was then re-milled and the core fitted and glued with shellack.

Two finished magnets had been produced by the 20th of November 1953. Until then, no electrical measurements had been made. However, most other parts of the clutch were nearly complete.

It was planned that the next construction would no longer contain a twelve segment magnet, but would instead consist of a rotating body where the component sheet metal elements were to be stamped in the form of two semi-circular segments. It was hoped thus to simplify construction and gluing, and to improve insulation as well as reduce wear during operation.

Source does not know if this project was carried to a successful conclusion as he was returned to the DDR at this point in the work.

9. Eight Trace Recording Oscillograph: The 8-trace oscillograph (8 cathode ray tubes) was intended for the measurement and photographic recording of electric processes (to 2m per second) (See Figure 18). The design for this oscillograph was made by IHLE and WENDT, both engineers. This being the second model, experience gained from the first model was utilized so as to make all parts more accessible for repair. Its parts were easily assembled and the electric wiring was simple and easily accessible. The camera and control box were designed by the Soviet, DIKOVSKAYA (wife of SHONDRIKOV). Construction was begun in March 1953. It was completed 15 November 1953 after a one and one-half month interruption.

10. Centrifuge Test Stand: Design drawings were prepared in Moscow (probably based on early proposals made on the island). The drawings were altered by FISCHER and STIPLANSILDER in order to introduce the hydraulic system. These alterations caused some changes in the reduction gear.

The centrifuge stand was designed for the examination of electric and hydraulic steering apparatus of rockets under various "G" loads. (See Figure 19).

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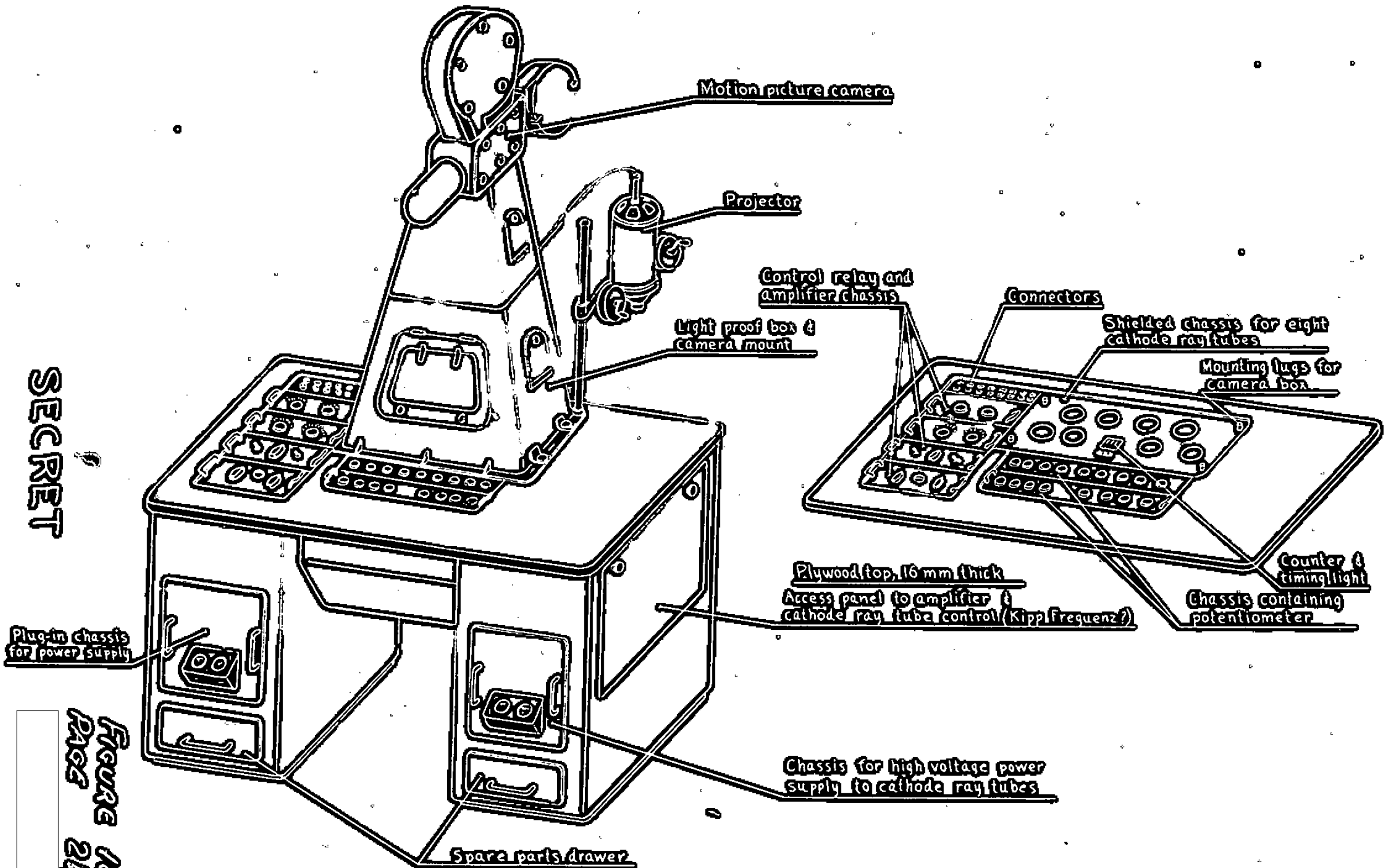

EIGHT TRACE OSCILLOGRAPH

FIGURE 18
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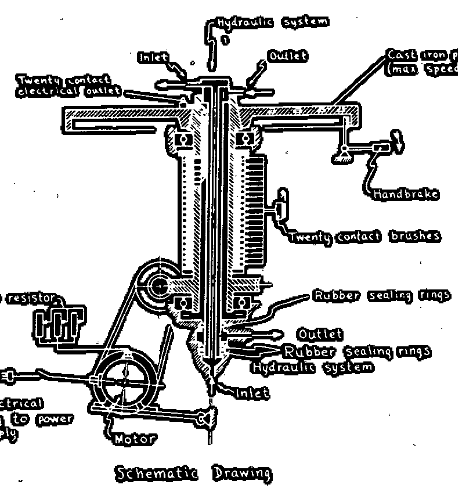
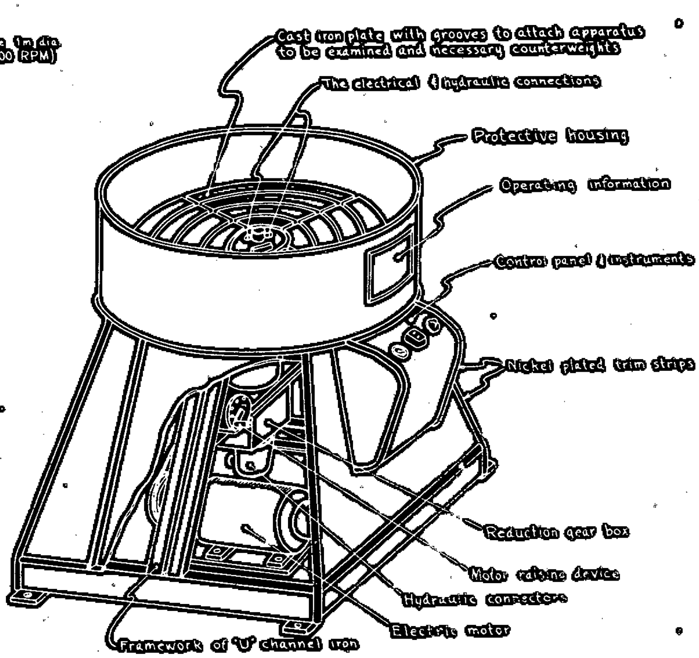


Schematic Drawing



CENTRIFUGAL TEST STAND

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FIGURE 19
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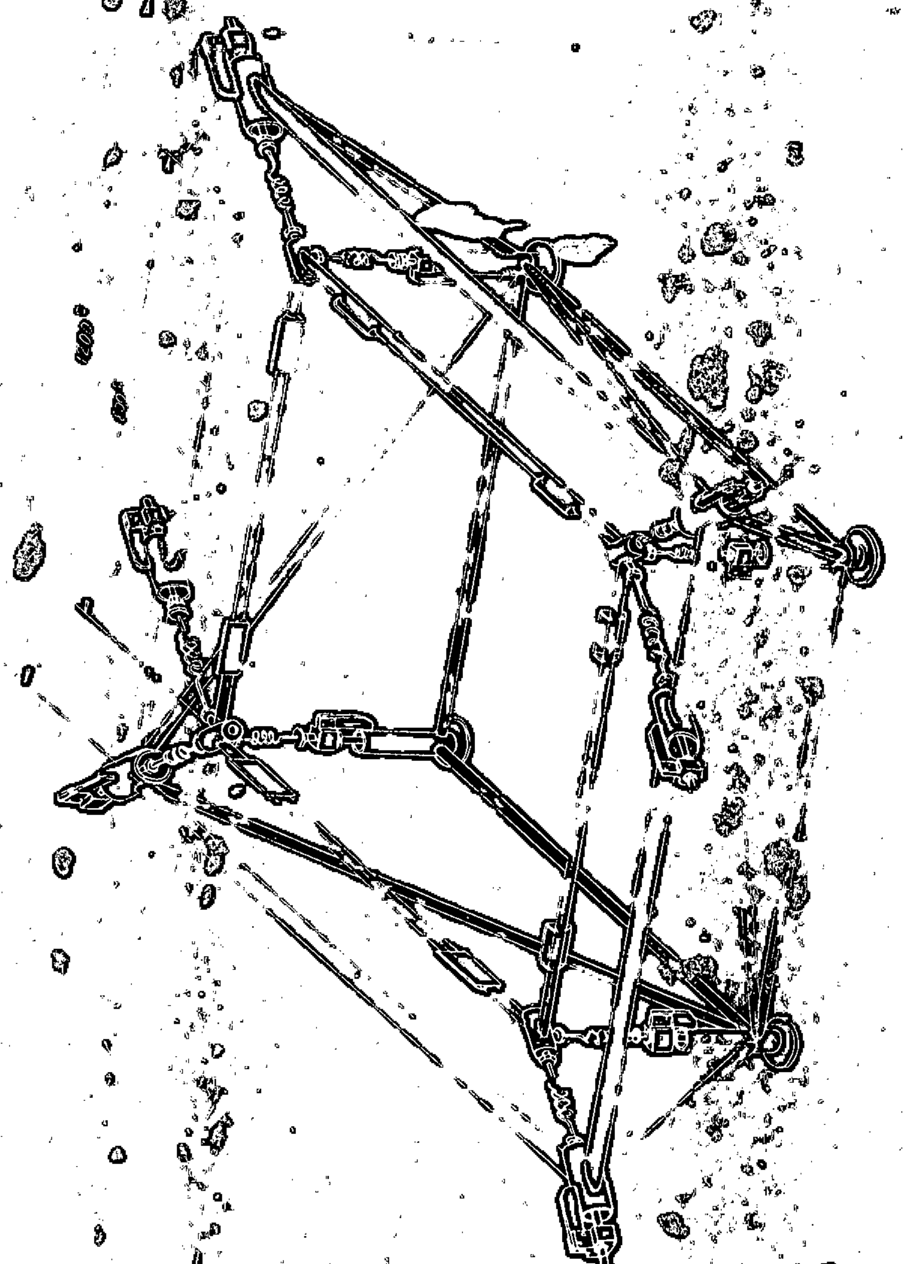

SUSPENSION FRAME

FIGURE 20
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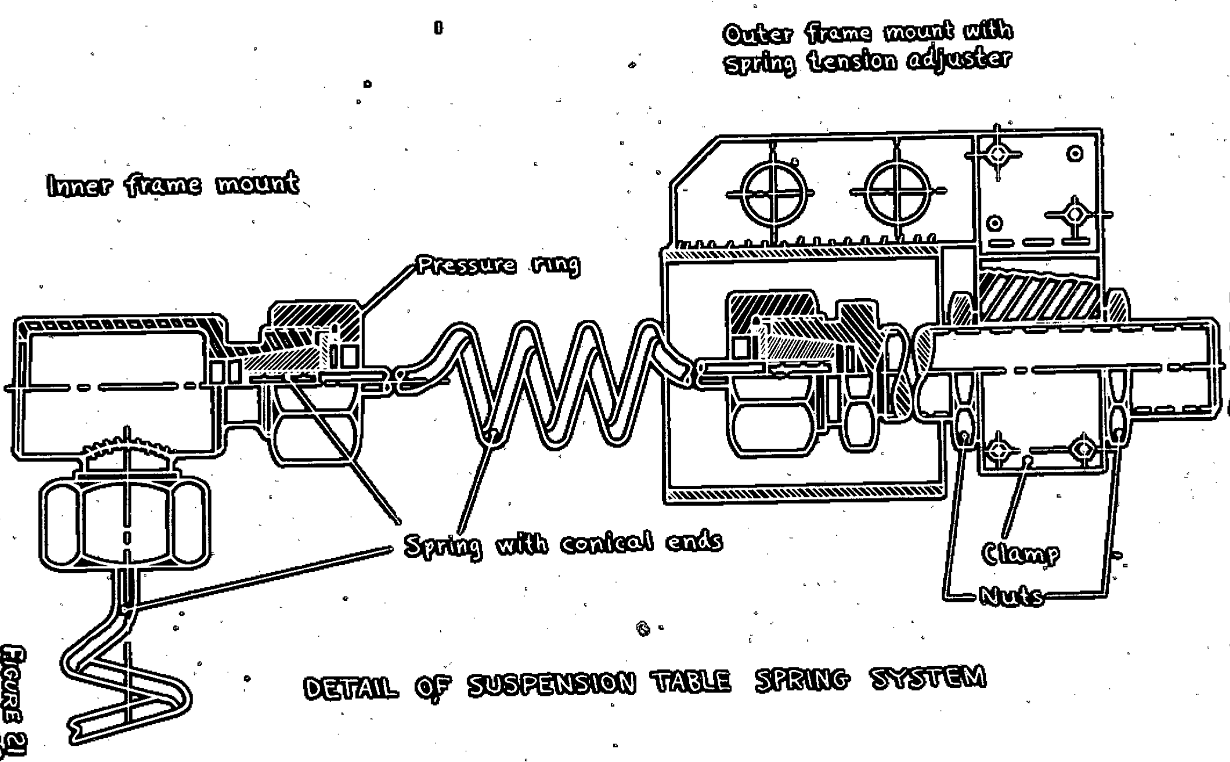

DETAIL OF SUSPENSION TABLE SPRING SYSTEM

FIGURE 21
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It was pointed out to the Soviets that if this system would first have to pass through the whole region of frequencies until it reached the required frequency of 50 cycles, the system would fail. They did not know what to answer, and finally a decision was reached [redacted] not to worry about the range of frequencies, but rather should assume that the system had attained the required frequency of 50 cycles. This is not impossible. For if the excitation is given by alternating current, 50 cycles will be attained immediately. The traversing of resonance arises only if the excitation is given by unbalanced machine. Then the system must pass through the entire range of frequencies up to 50 cycles. [redacted] the exciter was 50 cycles and the amplitude was .8mm (at the suspension points). [redacted] the Soviets at Borodomlya received the assignment from some other place [redacted] 50X1-HUM 50X1-HUM 50X1-HUM

It was originally thought [redacted] that only the spring system would go into a missile, by mounting on the inner walls, and that the frame was to be used only for tests. Consequently, the strength formulas for the springs were not applicable to the frame. That is, the 5 G's did not apply to the frame, but only to the springs. The actual place in the missile in which this unit was to be used was kept under severe secrecy and was not known [redacted] 50X1-HUM 50X1-HUM

[redacted] the unit which was to be suspended in this elastic mount [redacted] to be mounted in such a way in a missile as to be in contact with the surrounding media (i.e., air). What the unit was which was to be suspended is unknown, but the most striking requirement was that the rotation was to be very small (i.e., 20 minutes). This would indicate that it dealt with a unit that transmitted directional beams for very long distances where a small deviation of angle can cause a great error. In other words, it looks like a unit of a missile intended for transmission or reception of radio signals. Due to the fact that slight angular rotations are not so important in radio reception, [redacted] the unit was a transmitter. [redacted] 50X1-HUM

[redacted] 50X1-HUM

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